PROBIOTICS AND HERBS IN CARP (*CYPRINUS CARPIO* L.) POND AQUACULTURE – IMPACT ON FISH GROWTH, HEALTH AND PRODUCTION EFFICIENCY

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PROBIOTICI I LEKOVITO BILJE U UZGOJU ŠARANA (*CYPRINUS CARPIO* L.) U ZEMLJANIM BAZENIMA - UTICAJ NA PRIRAST RIBE, ZDRAVLJE I PROIZVODNE REZULTATE

Apstrakt

Cilj ovog rada je da prikaže rezultate ishrane šarana tradicionalnom smešom žitarica (tritikale + pšenica) sa dodatkom probiotika i/ili lekovitog bilja.

Kao probiotik korišćen je koncentrat EmFarma, koji je obezbedio „ProBiotics Polska" iz Poljske. Ova smesa sadrži skup sledećih mikroorganizama, bakterija i gljivica: *Bifidobacterium animalis, Bifidobacterium bifidum, Bifidobacterium longum, Lactobacillus acidophilus, Lactobacillus bulgaricus, Lactobacillus casei, Lactobacillus delbrueckii, Lactobacillus plantarum, Lactococcus diacetylactis, Lactococcus lactis, Streptococcus thermophilus, Bacillus subtilis var natto, Saccharomyces cerevisiae and Rhodopseudomonas palustris*. Koncentrat probiotskih mikroorganizama dodat je u mleveni kukuruz u količini od 2 litra preparata na 1 tonu hraniva. Pre dodavanja hranivima probiotski preparat je razređen u vodi. Količina dodate vode bila je oko 10% od težine hrane. Posle mešanja probiotika sa kukuruzom, hranivo je ostavljeno dva sata da nabubri.

Lekovito bilje sastojalo se od praha *Terminalia chebula, Phyllantus emblica, Andrographis paniculata, Tinospora cordifolia* i *Boerhaavia difusa*. Biljni preparat dobijen je od kompanije Farmwet iz Poljske. Mešavina bilja dodata je u količini od 3 kg na tonu kukuruzne prekrupe. Bilje u prahu pomešano je sa prekrupom, zatim navlaženo vodom u količini od oko 10% od doze hrane i ostavljeno dva sata da nabubri.

Ispitivanje je vršeno na šest hranidbenih grupa:
- I - samo prirodna hrana (kontrolna grupa)
- II - smeša sa kukuruznom prekrupom
- III - smeša sa kukuruznom prekrupom obogaćena probioticima
- IV - smeša sa kukuruznom prekrupom obogaćena lekovitim biljem
- V - smeša sa kukuruznom prekrupom obogaćena probioticima i lekovitim biljem
- VI - peletirana hrana Aller Aqua (referentna grupa)

Eksperimentalne smeše korišćene su za ishranu šaranske mlađi (C1), dvogodišnjaka za dalji uzgoj (C2) i konzumnih šarana (C3). Gustine nasada šarana bile su sledeće:
- za C1– 20000 jedinki/ha
- za C2– 5000 jedinki/ha
- za C3–1500 jedinki/ha

Sledeći parametri su mereni i analizirani:
- završna telesna masa (g/jedinka)
- prinos (kg/ha)
- stopa preživljavanja (S)
- stopa konverzije hrane, FCR (kg)
- Fultonov koeficijent (F)
- broj parazita (*Trichodina–Trich., Chilodonella–Chil., Epistylis–Epist., Costia*,)
- nivo lizozima (mg/l)
- nivo gama globulina (g/l)

Ključne reči: šaran, tradicionalan uzgoj u bazenima, održivost, probiotici, bilje

Tabela 1. Rezultati ishrane šaranske mlađi (C1) smešom žitarica sa dodatkom probiotika i/ili lekovitog bilja

Grupa	Težina g/jed.	S (%)	FCR (kg)	F	Prinos kg/ha	*Trich.*	*Chil.*	*Epist.*	*Costia*	Lisozyme	Gama globulini
I	29	42	0	1,68	241	18	28	22	17	$2,3^{b}$	$9,6^{b}$
II	66	45	2,6	1,71	594	17	22	19	33	$2,6^{ab}$	$6,9^{a}$
III	66	64	2,4	2,18	845	16	11	9	12	$1,8^{a}$	$7,1^{ab}$
IV	66	50	2,3	1,93	660	5	5	6	10	$2,4^{ab}$	$10,0^{b}$
V	64	63	2,7	1,82	806	8	11	11	11	$3,2^{b}$	$8,7^{ab}$
VI	75	83	0,7	2,01	1245	0	1	0	0	$3,1^{b}$	$10,4^{b}$

U okviru kolona, podaci obeleženi različitim slovima značajno se razlikuju ($P<0,05$), a obeleženi istim slovima nalaze se u istoj homogenoj grupi.

Tabela 2. Rezultati ishrane dvogodišnjih šarana za dalji uzgoj (C2) smešom žitarica sa dodatkom probiotika i/ili lekovitog bilja

Grupa	Težina g/jed.	S (%)	FCR (kg)	F	Prinos kg/ha	*Trich.*	*Chil.*	*Epist.*	*Costia*	Lisozyme	Gama globulini
I	86	45	0	1,18	196	35	31	42	21	0,82[a]	6,6[a]
II	209	92	2,2	1,56	967	23	39	22	32	0,96[a]	10,6[b]
III	216	82	1,8	1,51	891	12	12	6	11	-	-
IV	214	98	1,7	1,52	1043	12	4	8	0	0,78[a]	16,6[c]
V	315	85	1,2	1,70	1350	3	4	2	3	1,29[b]	15,3[c]
VI	346	98	0,9	2,02	1695	5	0	0	2	1,03[ab]	15,5[c]

U okviru kolona, podaci obeleženi različitim slovima značajno se razlikuju (P<0,05), a obeleženi istim slovima nalaze se u istoj homogenoj grupi.

Tabela 3. Rezultati ishrane konzumnih šarana (C3) smešom žitarica sa dodatkom probiotika i/ili lekovitog bilja

Grupa	Težina g/jed.	S (%)	FCR (kg)	F	Prinos kg/ha	*Trich.*	*Chil.*	*Epist.*	*Costia*	Lisozyme	Gama globulini
I	658	67	0	1,32	661	12	18	22	11	1,6[a]	11,8[c]
II	1367	100	4,0	1,93	2051	13	14	22	32	2,3[b]	5,5[a]
III	1386	100	3,5	1,92	2079	10	15	6	21	2,0[ab]	8,2[b]
IV	1325	100	3,8	1,97	1988	0	3	2	2	1,7[ab]	9,4[b]
V	1391	100	3,6	2,02	2087	1	3	4	3	1,9[ab]	9,3[b]
VI	1749	100	2,0	2,10	2624	2	0	1	0	1,8[ab]	9,9[b]

U okviru kolona, podaci obeleženi različitim slovima značajno se razlikuju (P<0,05), a obeleženi istim slovima nalaze se u istoj homogenoj grupi.

Korišćenje probiotika i lekovitog bilja imalo je pozitivan efekat na prirast, stopu preživljavanja i ukupni prinos šarana koji su gajeni u zemljanim bazenima i hranjeni tradicionalnom smešom žitarica;

Korišćenje probiotika i/ili lekovitog bilja imalo je pozitivan efekat na uzimanje hrane, a stopa konverzije hrane (FCR) obično je bila smanjena 10% - 15% u grupama u kojima su korišćeni dodaci;

Dodatak probiotika i/ili lekovitog bilja smanjio je broj najčešćih spoljnih parazita kod šarana (*Trichodina, Chilodonella, Epistylis* i *Costia*);

Probiotici i lekovito bilje kod šarana su pokazali pozitivan efekat na otpornost na bolesti. Tradicionalna smeša žitarica obogaćena probioticima i/ili lekovitim biljem stimulativno je delovala na povećanje nivoa gama globulina. Pozitivan efekat bio je posebno uočen kada su oba dodatka korišćena zajedno;

Kod šaranske mlađi (C1) probiotici i lekovito bilje ne treba da se primenjuju zajedno jer je u tom slučaju primećen smanjen prirast i nivo gama globulina.

Abstract

The aim of the paper is to present the results of feeding carp with traditional grain diet (triticale + wheat) supplemented with probiotics and/or herbs.

As probiotics, the EmFarma concentrate, provided by ProBiotics Polska, Poland,was used. This preparation contains consortia of the following microbial bacteria and fungi: *Bifidobacterium animalis, Bifidobacterium bifidum, Bifidobacterium longum, Lactobacillus acidophilus, Lactobacillus bulgaricus, Lactobacillus casei, Lactobacillus delbrueckii, Lactobacillus plantarum, Lactococcus diacetylactis, Lactococcus lactis, Streptococcus thermophilus, Bacillus subtilis var natto, Saccharomyces cerevisiae and Rhodopseudomonas palustris.* The concentrate of probiotic microorganisms was added to the ground corn in an amount of 2 liters of preparation per 1 ton of feed. Prior to adding to the feedstuff, the probiotics were diluted in water. The amount of added water was approximately 10% of feed weight. After mixing probiotics with corn, the feed was left for two hours for swelling.

The composition of herbs consisted of powdered *Terminalia chebula, Phyllantus emblica, Andrographis paniculata, Tinospora cordifolia* and *Boerhaavia difusa*. The herbal preparation was obtained from the Farmwet company, Poland. The blend of herbs was added in the amount of 3 kg per ton of ground corn feed. The powdered herbs were mixed with grinded corn, moistened with water amounting to approximately 10% of feed dose and left for two hours for swelling.

Six feeding groups were examined:

- I - natural food only (control group)
- II - ground mix of corn
- III - ground mix of corn supplemented with probiotics
- IV - ground mix of corn supplemented with herbs
- V - ground mix of corn supplemented with probiotics and herb
- VI - pelleted feed Aller Aqua (referential group)

Experimental diets were used for feeding carp fingerlings (C1), two-year restocking material (C2) and consumable carps (C3). Stocking densities of carp, were as follows:

- for C1– 20000 ind./ha
- for C2– 5000 ind./ha
- for C3–1500 ind./ha

The following parameters were measured and analyzed:

- final body mass (g/ind.)
- yield (kg/ha)
- survival rate (S)
- FCR (kg)
- Fulton's coefficient (F)
- number of parasites (*Trichodina–Trich., Chilodonella–Chil., Epistylis–Epist., Costia*,)
- level of lisozyme (mg/l)
- level of gamma globulins (g/l)

Key words: carp, traditional pond aquaculture, sustainability, probiotics, herbs

RESULTS

Table 1. The results of feeding carp fingerlings (C1) with grain diet supplemented with probiotics and/or herbs

Group	Weight g/ind.	S (%)	FCR (kg)	F	Yield kg/ha	*Trich.*	*Chil.*	*Epist.*	*Costia*	Lisozyme	Gamma globulins
I	29	42	0	1.68	241	18	28	22	17	2.3^{b}	9.6^{b}
II	66	45	2,6	1.71	594	17	22	19	33	2.6^{ab}	6.9^{a}
III	66	64	2,4	2.18	845	16	11	9	12	1.8^{a}	7.1^{ab}
IV	66	50	2,3	1.93	660	5	5	6	10	2.4^{ab}	10.0^{b}
V	64	63	2,7	1.82	806	8	11	11	11	3.2^{b}	8.7^{ab}
VI	75	83	0,7	2.01	1245	0	1	0	0	3.1^{b}	10.4^{b}

Within columns, data with different letters differs significantly (P<0,05), with the same letters are in the same homogenous group.

Table 2. The results of feeding two-year carp stocking material (C2) with grain diet supplemented with probiotics and/or herbs

Group	Weight g/ind.	S (%)	FCR (kg)	F	Yield kg/ha	*Trich.*	*Chil.*	*Epist.*	*Costia*	Lisozyme	Gamma globulins
I	86	45	0	1.18	196	35	31	42	21	0.82^{a}	6.6^{a}
II	209	92	2.2	1.56	967	23	39	22	32	0.96^{a}	10.6^{b}
III	216	82	1.8	1.51	891	12	12	6	11	-	-
IV	214	98	1.7	1.52	1043	12	4	8	0	0.78^{a}	16.6^{c}
V	315	85	1.2	1.70	1350	3	4	2	3	1.29^{b}	15.3^{c}
VI	346	98	0.9	2.02	1695	5	0	0	2	1.03^{ab}	15.5^{c}

Within columns, data with different letters differs significantly (P<0,05), with the same letters are in the same homogenous group.

Table 3. The results of feeding consumable carps (C3) with grain diet supplemented with probiotics and/or herbs

Group	Weight g/ind.	S (%)	FCR (kg)	F	Yield kg/ha	*Trich.*	*Chil.*	*Epist.*	*Costia*	Lisozyme	Gamma globulins
I	658	67	0	1.32	661	12	18	22	11	1.6^{a}	11.8^{c}
II	1367	100	4.0	1.93	2051	13	14	22	32	2.3^{b}	5.5^{a}
III	1386	100	3.5	1.92	2079	10	15	6	21	2.0^{ab}	8.2^{b}
IV	1325	100	3.8	1.97	1988	0	3	2	2	1.7^{ab}	9.4^{b}
V	1391	100	3.6	2.02	2087	1	3	4	3	1.9^{ab}	9.3^{b}
VI	1749	100	2.0	2.10	2624	2	0	1	0	1.8^{ab}	9.9^{b}

Within columns, data with different letters differs significantly ($P<0.05$), with the same letters are in the same homogenous group.

CONCLUSIONS

- the use of probiotics and herbs has had positive effect on growth, survival rate and total yield of carp reared in earthen ponds and fed traditional grain diet;
- the use of probiotics and/or herbs has had positive impact on food intake, food conversion rate (FCR) was usually reduced in 10% - 15% in groups where supplements were applied;
- the addition of probiotics and/or herbs decreased the number of the most common external parasites of carp (*Trichodina, Chilodonella, Epistylis and Costia*);
- probiotics and herbs presented positive effect on carp disease resistance. Supplementation of traditional grain diet with probiotics and/or herbs stimulated higher gamma globulins level. The positive effect was especially observed when both additives are used together;
- in case of carp fingerlings (C1) probiotics and herbs should not be applied together because when used together reduction of fish growth and gamma globulin level was observed.